
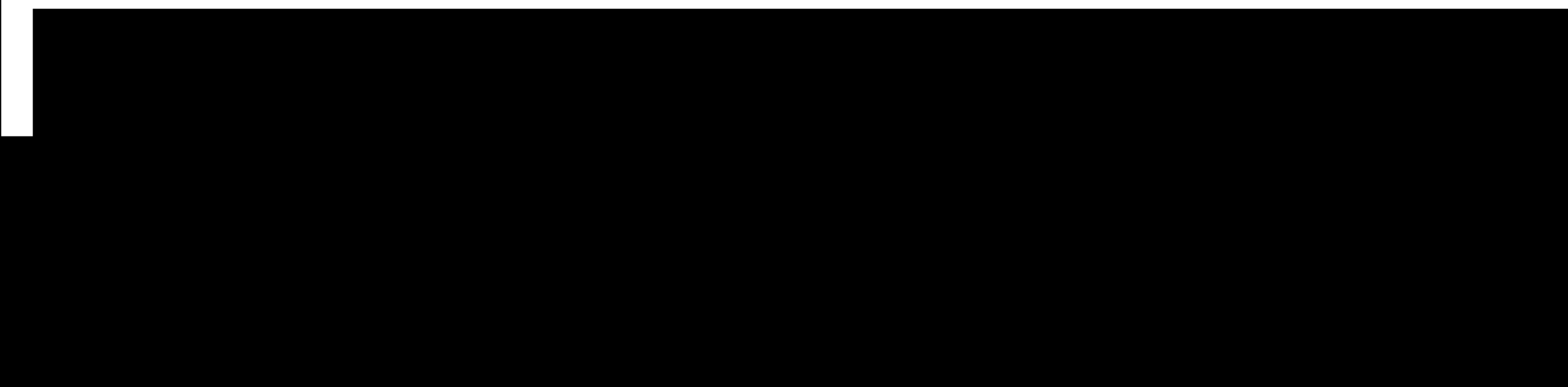

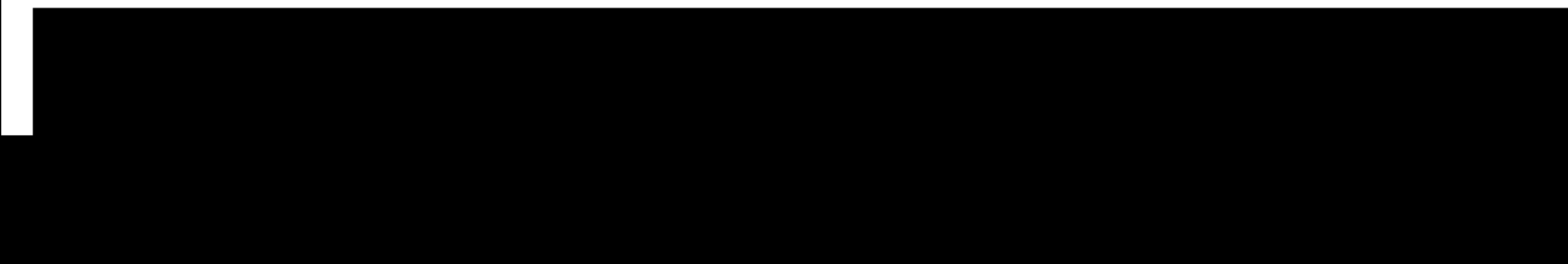


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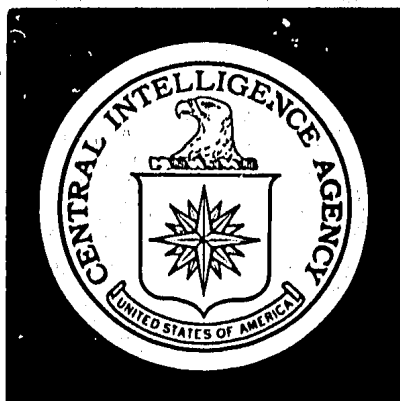


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DIRECTORATE OF
INTELLIGENCE

Intelligence Memorandum

South Africa: The Economic Cost Of Apartheid

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September 1970

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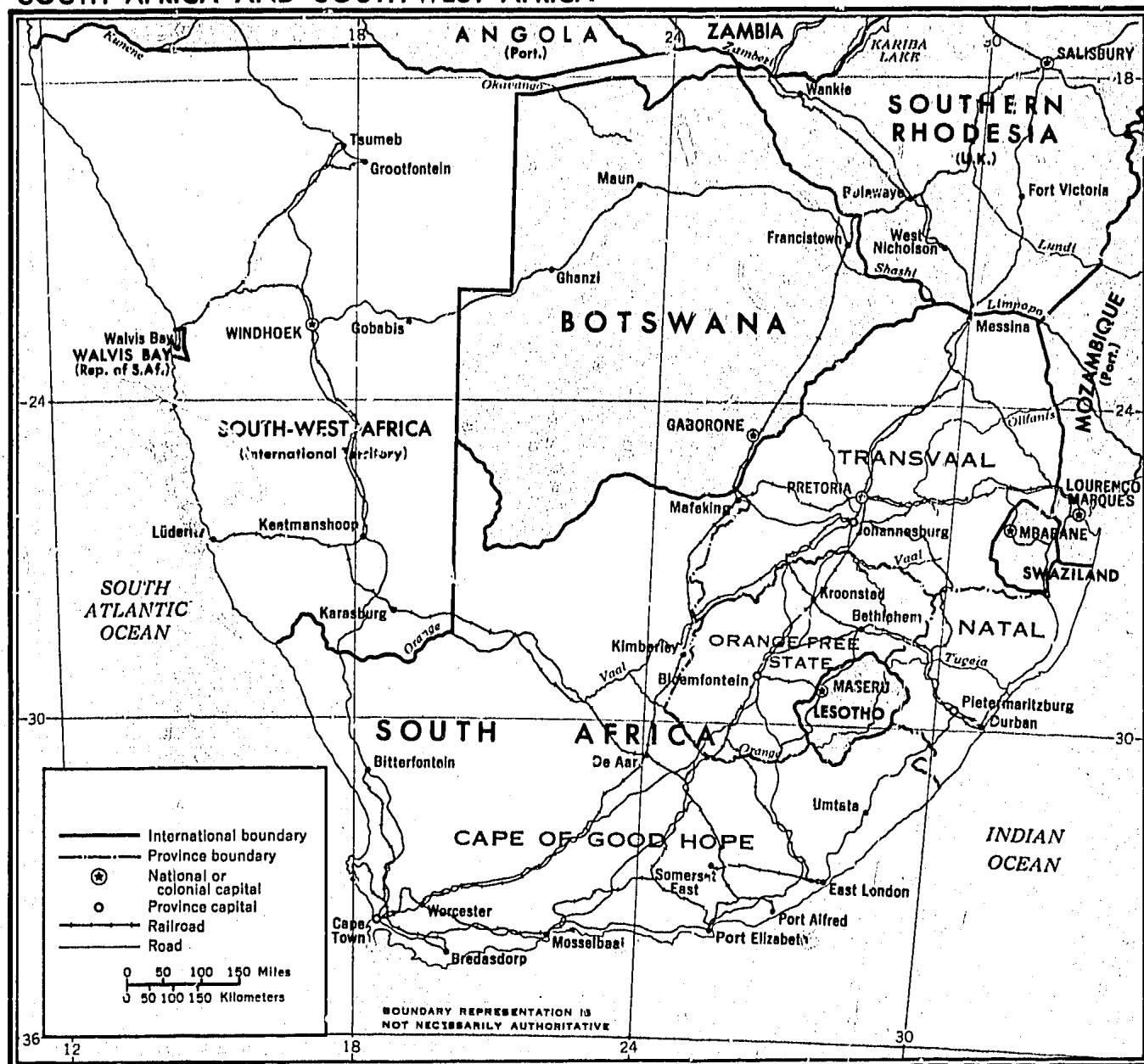
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SOUTH AFRICA AND SOUTH-WEST AFRICA



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CENTRAL INTELLIGENCE AGENCY
Directorate of Intelligence
September 1970

INTELLIGENCE MEMORANDUM

South Africa: The Economic Cost Of Apartheid*

Introduction

South African racial policies are extremely restrictive, and the range of economic activity allowed the non-whites is markedly circumscribed. As a result, a widely voiced view holds that the country is faced with a severe manpower shortage that is restricting economic growth. Economic pressures, it is argued, may force a relaxation of at least some of the legislative and institutional restrictions on the use of non-white labor and permit increased participation of non-whites in the economy. This memorandum attempts to evaluate these economic pressures by assessing South Africa's growth prospects within the present system and the economic cost attributable to apartheid.

Background

1. Racial discrimination in employment has existed in South Africa since the earliest white settlement. These traditional practices were not legally sanctioned until 1911 when certain jobs in

* The term South Africa as used in this memorandum includes the Republic of South Africa and the International Territory of South-West Africa.

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the mines were reserved for workers with "certificates of competence," which were issued only to white workers. The increasing unemployment of unskilled whites during the economic depression that followed World I, particularly in agriculture, led to a series of violent strikes in the early 1920s by white workers who wanted the restrictive system extended. Although the white labor movement was unable to develop effective economic leverage, it gained political control of the government in 1924 and introduced the so-called "civilized labor policy."

2. The keystone of the "civilized labor policy" was continued labor segregation with whites filling skilled and supervisory positions, Asiatics and coloreds filling semi-skilled and service positions, and blacks filling unskilled positions.* The objective of the government's labor program through the 1930s and World War II was to assure the white workers a high standard of living. The government employed a variety of tools to force compliance, including granting preference in government purchases and tariff protection to those industries that complied. In addition, a number of occupations were reserved for white workers in the mines, and government jobs were created for the unskilled white workers that industry and mining could not afford.

3. Following World War II, the newly formed Afrikaans-dominated Nationalist Party, responding to tensions generated by the large influx of non-whites to urban areas during the war, adopted the concept of greater geographic separation between the races. Following the party's victory in 1948, Dr. Henrick Verwoerd, later a Nationalist Prime Minister, developed this concept into the more comprehensive apartheid ideology of total racial separation. To implement apartheid, the government,

* The principal ethnic groups in South Africa are: Asiatics, primarily Indian but including all members of the Mongolian race except the Japanese who are considered "honorary whites" (591,000); blacks, descendants of any aboriginal group, particularly the Bantu African tribes (13,340,000); whites, all members of the Caucasian race (3,728,000); coloreds, primarily descendants of mixed (black-white) parentage but including all persons not otherwise classified (1,959,000).

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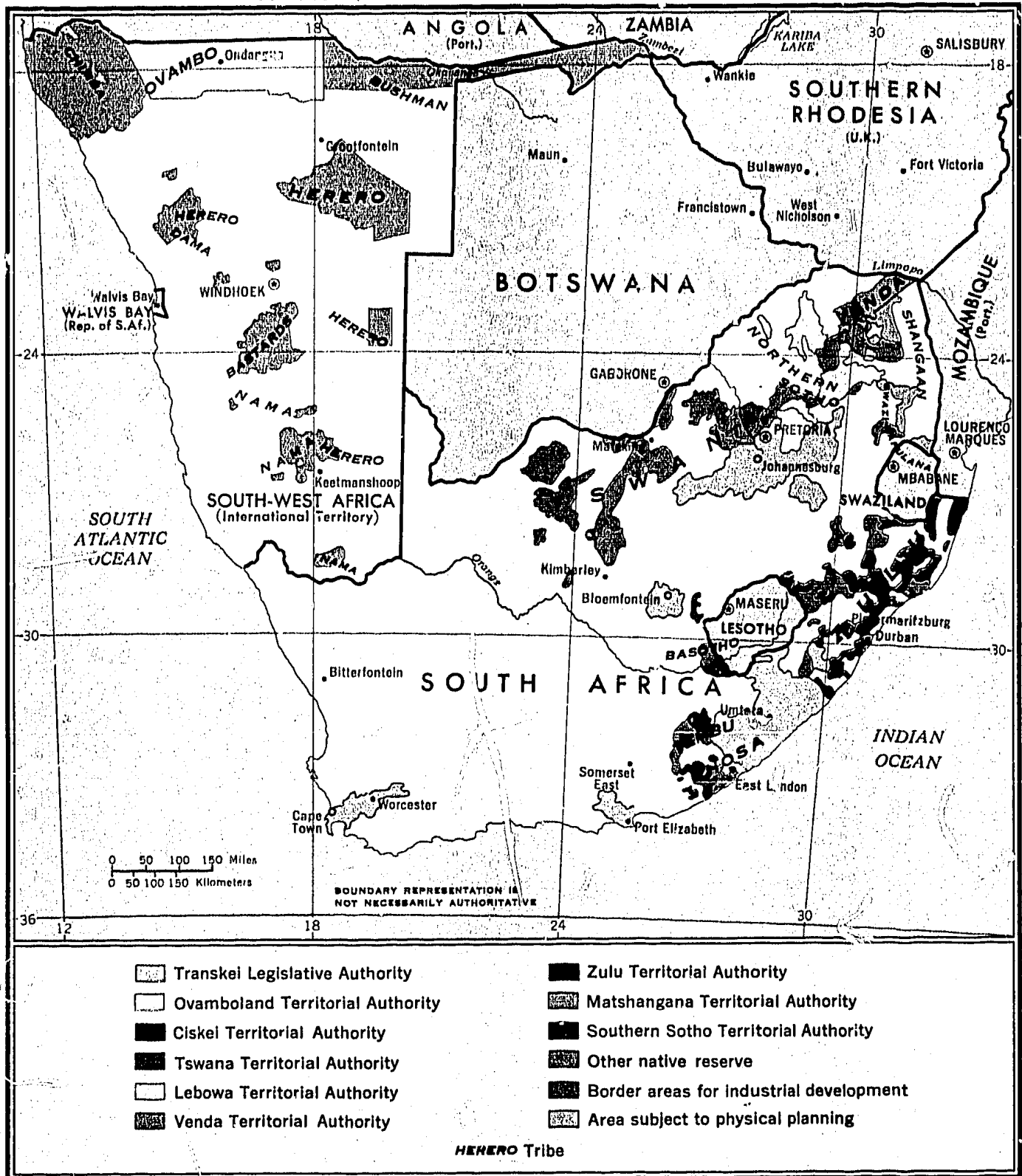
since 1948, has enacted legislation restricting the economic, legal, social, and residential rights of all people, particularly non-whites.

4. The economic intent of apartheid legislation during the fifties and early sixties was similar to that of the "civilized labor policy." The Nationalists used the administrative and economic tools at their disposal to maintain the existing racial composition of the labor force. A number of occupations were reserved by legislation for whites in manufacturing, services, and mining. Labor segregation also was perpetuated by restrictions embodied in labor contracts. Certain positions were reserved for white workers or for skilled journeymen, who, because of racial restrictions in apprenticeship programs, were white. Union insistence on the "rate for a job," or equal pay regardless of race for a particular task, was another measure that excluded non-whites from jobs that traditionally had been filled by whites. Except in unusual circumstances, employers found it uneconomic to fill a position previously occupied by whites, and for which a white pay scale had been established, with a generally less productive non-white.

5. The Nationalists, in the aftermath of the Sharpeville massacre in 1960, extended their legislative program to include influx controls (restriction of the migration of non-whites to urban areas). Under the Physical Planning Act, the establishment or expansion of factories that would employ additional black workers required government approval in 37 districts, which included most important economic entities (see the map). Blacks were denied the right to acquire residential rights in urban areas, and many workers' dependents were moved to the reserves, which are considered the legal home of the black population. Potential workers on reserves, or so-called homelands or bantustans, are required to deal with government bureaus and are limited to one-year labor contracts, after which they must return to their reserves for at least one month.

6. Although blacks and other non-whites are excluded from job opportunities in white South Africa, they are, according to apartheid theory, to have equivalent opportunities in their own areas.

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The South Africans have, therefore, formulated a program of homeland development. Adequate job opportunities are to be created within the homelands to employ those who are unable to find jobs elsewhere in South Africa. The homeland development concept has not, however, been realized in practice. In the Transkei, the most developed bantustan, only about 10% of those in paid employment are employed within the homeland. Of this number, 75% are either employed by the Transkei or South African government or are domestic servants. In all the homelands, only about 100 jobs have been developed per year in manufacturing.

7. The stated objectives of apartheid policy in the 1970s are extensions of those of the 1960s. The government hopes to reduce and by 1978 to halt and reverse the inflow of black workers to urban areas and to remove most black dependents to the homelands. In addition, the government seeks to maintain labor segregation and the racial composition of the labor force.

The Restrictive System

8. The economic effect of each of the three principal restrictive instruments of the "civilized labor" and apartheid policies -- government influence to maintain the racial composition of the labor force, job reservation, and "rate for a job" -- is similar. All three perpetuate labor segregation and protect the existing white/non-white labor ratio. Government influence to maintain the racial composition of the labor force, supplemented by legislation requiring the maintenance of existing white/non-white labor ratios in specific industries or occupations, achieves this effect directly. Job reservation and "rate for a job," although permitting some work simplification through which a number of non-whites may perform tasks previously performed by white, generally prevent movement of non-whites into white positions.

9. The economic effect of influx control varies among geographic areas. In the 37 controlled districts, influx control, when enforced, shifts the racial composition of the labor force in favor of whites, or at least non-Africans. This restriction on labor supply probably slows the industrial growth of the area itself. In non-controlled districts,

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influx control leaves the racial composition of the labor force unchanged, and the resulting availability of labor may, particularly in the border areas, stimulate industrial growth.

10. Enforcement of the restrictive practices and influx control measures has been flexible, and exemptions generally have been granted in cases where manpower shortages have been relatively severe. Government administrative and legislative power has been used sparingly to limit job simplification and assumption by non-whites of tasks formerly performed by whites. In government enterprises, particularly the railroads, certain unskilled jobs traditionally occupied by whites now are being filled on a temporary basis by non-whites with the consent of the white labor unions. Trade unions generally agree to non-whites assuming certain tasks previously performed by whites when white job security is guaranteed and the wages of white workers are increased. Partial exemptions also have been granted in a majority of cases where job reservation determinations have been made.

11. Exemptions from influx control regulations have been numerous. In 1968, the first year of the Physical Planning Act, exemptions were granted to employ about 65% of the blacks for whom exemptions were requested. Only about 22% of the annual increase in black employment outside of agriculture is absorbed in the border areas; the remainder continues to be employed in traditional locations.

12. In spite of these numerous compromises, however, labor segregation essentially has been realized. The white and non-white labor markets have been separated successfully, especially in manufacturing, and substitution of the labor of one race for another has been reduced substantially.* The racial composition of the labor force has been maintained despite a white labor shortage (as evidenced, in part, by a white unemployment rate of less than 0.5%) and a non-white labor surplus (as evidenced by the excess of non-white labor in agriculture). In manufacturing, probably also in mining, and in other secondary industry, the substitution of non-whites for whites has been minimal. In trade and in other services, although substitution has taken place, the ease of substitution has been reduced substantially.

* For empirical verification of this statement, see the Appendix.

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Prospects for Growth

13. Growth of the South African economy has been impressive despite the apartheid labor restrictions. Since 1933, real gross domestic product (GDP) has grown at an average annual rate of 4.5%. After World War II, growth accelerated and has averaged almost 6% annually in the past ten years.

14. The 6% rate of real growth achieved in the last decade exceeded the planned rate and no doubt was more than acceptable to South Africa. Under the Economic Development Programme for 1968-73, the South African economy is to grow at a rate of 5.5% annually (see Table 1), with the present system of labor restriction remaining essentially unchanged. Manufacturing output is to grow at a rate of 6.6% and output in trade at 5.4%. The demand for white and non-white labor in manufacturing is expected to increase through 1973 at 3.3% and 3.9% annually, respectively, and the stock of fixed capital at about 8% (see Tables 2 and 3).

15. South Africa should be able to achieve at least the planned growth in output, given the projected supply of domestic factors of production. If employment and capital stock in manufacturing increase as planned and technology and other influences on productive efficiency improve at the same rate as in the past, then a growth rate of 7% a year for manufacturing output -- slightly above the planned 6.6% rate -- seems feasible within the present restrictive system.* In trade, too, the planned growth rates for white and non-white labor -- 2.5% and 2.8%, respectively -- appear adequate under the present restrictive system to increase output in trade at about the planned 5.4% rate during 1970-75.**

16. Planned growth rates for other economic sectors -- mining, other secondary industry, other services, and agriculture -- also appear to be realistic, given the input assumptions of the Programme and continuation of the existing restrictive

* Based on a production function derived for the present restrictive system. See Appendix Table A1, equation 2'.

** See Appendix Table A2, equation 4.

Table 1
Projected Gross Domestic Product, by Sector a/

	Million Constant 1969 US \$							Average Annual Rate of Growth 1970-75 (Percent)
	1969	1970	1971	1972	1973	1974	1975	
Total	14,630	15,420	16,260	17,150	18,095	19,085	20,130	5.5
Mining	1,725	1,770	1,820	1,870	1,920	1,970	2,020	2.7
Secondary industry	4,035	4,310	4,600	4,915	5,250	5,605	5,985	6.8
Of which:								
Manufacturing	3,045	3,245	3,460	3,690	3,930	4,190	4,465	6.6
Services	7,390	7,810	8,255	8,725	9,225	9,750	10,305	5.7
Of which:								
Trade	2,035	2,145	2,260	2,385	2,510	2,650	2,790	5.4
Agriculture	1,480	1,530	1,585	1,640	1,700	1,760	1,820	3.5

a. Entries for the period 1969-73 are taken from the South African Development Programme for 1968-73; entries for 1974 and 1975 are estimates derived on the assumption of a continuation of Programme trends.

Table 2
Projected Labor Demand, by Sector ^{a/}

	Thousand Persons							Average Annual Rate of Growth 1970-75 (Percent)
	1969	1970	1971	1972	1973	1974	1975	
Labor demand (whites)	1,384	1,423	1,460	1,496	1,534	1,572	1,611	--
Mining	59	59	59	58	57	57	57	--
Secondary industry	345	358	371	384	398	413	428	3.7
Of which:								
Manufacturing	275	284	294	303	313	323	334	3.3
Services	865	891	916	940	966	990	1,014	2.7
Of which:								
Trade	211	216	222	228	233	239	245	2.5
Agriculture	115	115	114	114	113	112	112	--
Labor demand (non-whites)	5,382	5,516	5,654	5,797	5,945	6,098	6,257	--
Mining	540	537	534	532	529	526	524	--
Secondary industry	1,082	1,130	1,180	1,232	1,286	1,343	1,402	4.4
Of which:								
Manufacturing	815	847	880	914	950	987	1,025	3.9
Services	1,913	1,976	2,041	2,108	2,178	2,250	2,324	3.3
Of which:								
Trade	247	254	261	268	276	284	292	2.8
Agriculture	1,847	1,873	1,899	1,925	1,952	1,979	2,007	1.4

a. Entries for the period 1969-73 are taken from the South African Development Programme for 1968-73; entries for 1974 and 1975 are estimates derived on the assumption of a continuation of Programme trends.

Table 3
Projected Factor Availabilities a/

	1969	1970	1971	1972	1973	1974	1975	Average Annual Rate of Growth 1970-75 (Percent)
Million Constant 1969 US \$								
Current account foreign exchange availability b/	5,360	3,490	3,620	3,755	3,900	4,005	4,200	3.8
Thousand Persons								
Labor availability c/								
Whites:								
With 20,000 immigrants annually	--	--	1,459	1,491	1,524	1,558	1,592	2.2
With 30,000 immigrants annually	1,390	1,427	1,463	1,499	1,537	1,575	1,614	2.5
Non-whites	5,580	5,711	5,846	5,985	6,128	6,275	6,426	2.4
Million Constant 1969 US \$								
Capital availability d/								
Total	2,030	2,125	2,230	2,335	2,450	2,565	2,685	4.8
Mining	65	70	70	80	70	70	70	--
Secondary industry	465	485	505	530	560	585	615	4.8
Of which:								
Manufacturing	385	400	415	435	460	480	510	--
Services	1,420	1,485	1,560	1,630	1,725	1,810	1,900	5.0
Of which:								
Trade	80	85	90	95	100	105	110	--
Agriculture	80	85	95	95	95	100	100	3.8

a. Data for 1969-73 are from the South African Development Programme for 1968-73; data for 1974-75 are estimates derived on the assumption of a continuation of Programme trends.
b. Foreign exchange available to finance imports of goods and non-factor services. In order to estimate the total foreign exchange available to finance imports of goods and non-factor services, net private capital inflows and long-term public capital inflows must be included. Net private capital inflows have fluctuated widely but averaged \$320 million during each of the last three years, and long-term public capital inflows have averaged \$15 million.
c. Economically active population.
d. Net investment or additions to capital stock.

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system. The situation in mining and in other secondary industry is similar to that in manufacturing, while the situation in trade is probably fairly representative of the entire service sector. Few restrictions exist on non-white employment in agriculture. Consequently, achievement of planned growth for the economy as a whole seems compatible with the present restrictive system, making the case that easing apartheid is necessary to achieve planned growth difficult to support.

17. Indeed, growth may not approach a rate at which labor will become an effective constraint because another constraint -- the supply of foreign exchange -- probably will become operative first. The South African economy requires increased imports, especially of investment goods, to support increases in output. If past relationships between imports, GDP, and investment continue, imports will have to increase 4.8% a year to support planned growth of the economy. But the supply of foreign exchange to finance imports will grow at an average annual rate of only 3.8% according to Development Programme estimates (see Table 3). Gold output is expected to remain almost constant for the next several years before declining, while income from other exports is expected to rise at about the same rate as real product, or at about the 5.5% rate achieved annually during the 1960s.

18. The current account of the balance of payments probably will be in deficit through most of the 1969-75 period, and capital inflows, which averaged \$335 million during each of the last three years, are unlikely to be large enough to cover the entire deficit (see Table 4). Foreign exchange earnings and capital inflows almost certainly will not be large enough to support for long a growth rate high enough to generate labor shortages that could possibly be eased by relaxing restrictive policies. They may even be inadequate to support the growth rate envisioned in the Programme.

19. Easing apartheid regulations would probably have little impact on export earnings in the short term. The effect on exports of a relaxation of the restrictive labor practices normally would be to

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Table 4

Foreign Exchange Availability and Requirements

Million Constant 1969 US \$

Year	Foreign Exchange Available to Finance Imports of Goods and Services (Excluding Factor Payments) ^{a/}	Estimated Foreign Exchange Requirements for Goods and Services (Excluding Factor Payments) ^{b/}	Balance
1970	3,825	3,785	40
1971	3,953	3,975	-20
1972	4,090	4,175	-85
1973	4,235	4,380	-145
1974	4,340	4,615	-275
1975	4,535	4,860	-325

a. Official projection through 1973, continued to 1975, for current account earnings plus assumed earnings of \$335 million a year on capital account.

b. Estimated for the output and investment assumptions of the Economic Development Programme extended through 1975, using a statistical regression (see the Appendix).

reduce unit costs of production and make South African exports slightly more competitive. Because of the peculiarities of mining technology, however, a reduction in labor costs and hence in unit extractive cost would enable the mines to extract profitably a lower average grade of ore than they now do and thus could actually decrease gold output and exports in the short run.

Economic Cost of Apartheid

20. The apartheid system exploits non-white labor. Non-white workers are paid wages far below what they would receive in a free labor market -- or,

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in economic terms, far below the value of their marginal product. While their productivity on the average is probably about 30% that of whites in manufacturing, their average wage is only 14% of the average white wage. This exploitation is possible because of the considerable surplus of non-white labor and the restrictions on the substitution of non-whites for whites. Employment opportunities in agriculture -- the only sector where restrictions against non-white labor are minimal -- are very limited, and wages there are far below those paid for urban occupations. Non-white labor's share of income originating in manufacturing is only 30% while it would be about 37% if the labor market were free, even if education and skills remained unchanged (see Table 5). The beneficiaries of the system are, of course, the white workers, whose wages are higher than they would be in a free labor market and who suffer virtually no unemployment.

21. Apartheid creates a misallocation of resources by barring non-white workers from occupations where their productivity would be higher. It holds down the size of the non-white labor forces in secondary industry and mining, where productivity is relatively high, and to a lesser extent in trade and other services. At the same time it keeps non-white labor in traditional agriculture where labor productivity is very low. In manufacturing, where the restrictions are most stringent, it tends to give white and non-white workers complementary rather than competitive functions.

22. It is impossible to measure the overall cost of apartheid, because the system has existed as an integral part of the economy's development since the 1920s and even before. The total economy, including the sectoral distribution of labor and capital, the technology, the educational system, the composition of trade, and the pattern of demand have all been structured by the restrictive system. We can, however, approximate the cost that the apartheid system exacts as new resources are allocated.

23. We measure the cost of apartheid by estimating the difference between the potential growth of output under the existing restrictive system

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Table 5
Projected Output and Factor Returns in Manufacturing

Million Constant 1969 US \$						
Year	Projected in Economic Development Programme	Output				
		Projected for the Present Restrictive System	Projected in a Free Labor Market Situation			
1969	3,045	3,045	3,045			
1970	3,245	3,260	3,275			
1971	3,460	3,490	3,520			
1972	3,690	3,730	3,775			
1973	3,930	3,990	4,050			
1974	4,190	4,265	4,345			
1975	4,465	4,560	4,660			
Average annual rate of growth (percent)	6.6	7.0	7.4			
Factor Returns						
Year	Present Restrictive System			Free Labor Market Situation		
	Return to White Labor	Return to Non-White Labor	Return to Capital	Return to White Labor	Return to Non-White Labor	Return to Capital
1970	1,565	980	715	1,345	1,210	720
1975	2,190	1,370	1,000	1,910	1,725	1,025
Percent of output	48	30	22	41	37	22

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and the growth that might be achieved if the labor market in South Africa were free. There are three stages to the analysis:

-- The effect of apartheid on the growth of individual economic sectors using the sectoral labor projections of the Economic Development Programme;

-- Its effect on overall economic growth through a redistribution of total planned employment among sectors;

-- Its effect if the overall employment projections of the Programme are themselves changed.

24. The cost of the misallocation of labor within sectors was estimated by employing the white labor, non-white labor, and capital inputs projected in the Programme in production functions reflecting, alternatively, the present restrictive system and a free labor market.* In manufacturing the present restrictive system, which allows virtually no substitution of non-whites for white labor, reduces the annual rate of growth of output by 0.4% compared with a free labor market situation (see Table 5). The reason the effect is so small is that the Programme calls for only a slightly faster growth of non-white than of white employment -- a pattern consistent with trends of the past 30 years. In trade the additional cost of the existing system shows up as insignificant, partly because the system allows limited substitutability between the two types of labor and partly because their growth rates are very close (see Table 6). No calculation was attempted for agriculture, because of the absence there of any effective restrictions on the use of labor.

25. The effects of easing labor restrictions on intersectoral shifts in employment are difficult

* In technical terms, white and non-white labor inputs are represented in production functions using elasticities of substitution of zero for manufacturing, unity for trade, and infinity for a free labor market. See Appendix Table A1, equation 1 and equation 2'; and Appendix Table A2, equation 4.

Table 6

Projected Output in Trade

Year	Million Constant 1969 US \$		
	Projected in Economic Development Programme	Projected for the Present Restrictive System	Projected in a Free Labor Market Situation
1969	2,035	2,035	2,035
1970	2,145	2,140	2,140
1971	2,260	2,250	2,255
1972	2,385	2,370	2,375
1973	2,510	2,490	2,495
1974	2,650	2,620	2,625
1975	2,790	2,755	2,760
Average annual rate of growth (percent)	5.4	5.2	5.2

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to evaluate. Presumably, some increase in the growth in non-agricultural employment of non-whites at the expense of agricultural employment would take place, but the extent of the shift would depend on the time allowed for adjustment, the volume of investment, and many other factors. One possibility is that the non-white labor force in agriculture would remain constant instead of increasing as called for in the Programme. If this additional labor were shifted to other sectors in proportion to their projected employment levels, the growth of manufacturing output could increase about 0.2% a year and that of trade about 0.1% a year. Thus the total impact on both intrasectoral and intersectoral shifts in employment would be about 0.6% a year for manufacturing and about 0.1% for trade (see Table 7). Assuming, as we believe is reasonable, that the effect of apartheid in mining and other secondary industry is similar to that in manufacturing and the effect in other services is similar to that in trade, and assuming that withdrawal of labor from agriculture has no effect on agricultural output, the total cost of apartheid to the economy comes to about 0.2% a year.

26. These estimates accept the overall labor force projections of the Programme. However, the white labor force projections are sensitive to changes in the number of immigrants. Since 1961 the South African government, pursuing a vigorous campaign to encourage white immigration, has succeeded in raising the net number of white immigrants to more than 30,000 per year, and immigration at the rate of 30,000 to 40,000 annually is likely to continue through the 1970s. If the South Africans were unable to continue to attract this number of immigrants, the cost of maintaining the present restrictive system in manufacturing would become slightly greater -- although still not substantial.

27. If net white immigration declined, for example to 20,000 immigrants per year, the growth rate of the economically active white population, and consequently the growth rate of the white labor force, would decline by 12%. If the government tried to maintain the planned white and non-white labor ratio by reducing the growth of non-white employment, the effect on manufacturing would be to reduce output by about an additional

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Table 7

Prospects for Average Annual Rates of Growth
in the South African Economy
1970-75

	Manufacturing		Trade		Economy	
	Estimated for a Restricted Labor Market	Estimated for a Free Labor Market	Estimated for a Restricted Labor Market	Estimated for a Free Labor Market	Estimated for a Restricted Labor Market	Cost in Terms of Forgone Growth
Projected in the Economic Develop- ment Programme	6.6		5.4		5.5	
Estimated on the basis of the in- put assumptions of the Programme	7.0	7.4	5.2	5.2		-0.1
Estimated on the assumption that underemployed agricultural labor is reallocated	7.0	7.6	5.2	5.3		-0.2
Estimated on the assumption that net white immi- gration declines to 20,000 per year	6.8	7.3	5.0	5.1		-0.2
Estimated on the assumption that influx control measures are enforced	6.2					-0.5 a/

a. Assuming that underemployed agricultural labor is reallocated in a free labor market.

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0.1% a year from what could be achieved in a free labor market situation (see Table 7). In trade and in the economy in general, if the government sought to maintain the present restrictive system in the face of decreased immigration, the additional loss in output would also be about 0.1% a year. The effects on output of various white and non-white employment assumptions are summarized in Table 7.

28. It is also of interest to consider the effect on economic growth of even tighter restrictions -- of enforcing influx controls in manufacturing and accelerating development of border areas. About \$250 million has been spent in the border areas by the government since 1960 for such items as infrastructure, rail rebates, and loans. Most firms that move to the border areas do so because of the prohibitions of the Physical Planning Act, however, rather than in response to the government incentive program. The real cost of influx control is, therefore, probably greater than the cost of government incentives alone.

29. If influx control measures were enforced strictly, then the growth of the black labor force would be restricted to jobs created in border areas and the growth rate in the entire non-white labor force in manufacturing would be reduced to less than 2%. The average annual growth in manufacturing output consequently would be reduced by approximately 0.8% from what could be achieved without influx control and about 1.4% compared with a free labor market situation (see Table 7). If, as seems likely, strict influx control enforcement induced increased job formation in border areas, the cost would, however, be substantially less.

30. The foregoing discussion suggests that the amount of economic growth forgone because of apartheid policies is bound to be small in the next few years. Moreover, the growth forgone is in most cases much smaller than the loss of income white labor would suffer if the market became free. This situation might not be so in the long run if the non-white population were able through education and experience to raise its productivity. In the short run, however, a change to a free labor market would affect the income distribution more quickly than it would affect the allocation of

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labor and its productivity. The only case discussed above that might entail some cut in white labor income is the tight application of influx controls, which no doubt is why this measure has encountered opposition from a large part of the white population. Apartheid probably reduces the return to capital as well as non-white wages (although, of course, much less), but it is the white workers who have the votes. Since the supply of foreign exchange is likely to be more of a constraint on economic growth in the next few years than is the supply of labor, the chances seem slim that economic pressures to weaken apartheid will become stronger. Indeed, if foreign exchange shortages should force a marked economic slowdown, white labor would probably press for even tighter restrictions on non-white employment to protect its position.

Conclusions

31. Racial discrimination in employment has successfully separated the white and non-white labor markets in the South African economy. The separation has been accomplished and enforced through job reservation, restrictive labor contracts, and institutional segregation. Of the various sectors of the economy, manufacturing is most affected by the apartheid system.

32. Economic pressures to relax restrictive labor practices are unlikely to grow in the next few years. The supply and planned distribution of labor in South Africa during the first half of the 1970s appear to be adequate to achieve the planned rate of real growth in GDP of 5.5% per year. Indeed, the effective constraint on growth may not be labor but rather foreign exchange, the availability of which is not very sensitive to the degree of labor market restriction.

33. Maintaining the present restrictive system in the South African economy will exact only a small economic cost. Although the apartheid system exploits non-white labor, it probably will not over the next few years seriously inhibit economic growth. We calculate that maintaining the present

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restrictive system retards annual growth in GDP by only 0.2% from what could be achieved with the same total employment in a free labor market situation. This small economic cost, moreover, is borne by the non-whites, the population group least able to exert pressure to effect change.

34. The recent extension of apartheid legislation to include influx control in manufacturing has not been strictly enforced. Strict enforcement would increase the difference in growth rates to 1.4% in manufacturing and by about 0.5% in the economy overall. This cost would probably be borne by the white population to a greater extent than has been the case in the existing restrictive system. The opposition of the potentially affected whites will probably inhibit strict enforcement in manufacturing and prevent the extension of influx control to other sectors.

35. In spite of the absence of economic pressures to force a relaxation in the present restrictive system, the sharp differences that exist between apartheid in theory and in practice probably will widen although slowly. The government is not likely to promulgate the job reservation determinations in the service sector that were announced during the recent election campaign or seek to remove the numerous job reservation exemptions that previously had been granted. The government also probably will not seek to prevent the slow increase in the non-white/white labor ratio in the non-agricultural economy.

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APPENDIX

MethodologyDescription of the Production Functions

The statistical analysis of the effects of apartheid makes use of production functions in manufacturing and trade of the general form:

$$Y = AL^{\alpha} K^{1-\alpha} e^{\lambda t}$$

where Y = output, L = employment,
K = capital stock, and t = time

In this function, labor and capital inputs are combined by means of constant weights, which means that the elasticity of substitution (a measure of the ease with which inputs can be substituted for each other in production) is equal to one between these inputs. The coefficients α and $(1-\alpha)$ represent the contribution to production of labor and capital, respectively (and, if labor and capital markets are competitive, also measure their income shares). The coefficient λ incorporates new technology, qualitative improvements in labor and capital inputs, changes in the use of other unspecified inputs, and all other factors not accounted for by quantitative changes in labor and capital. The coefficient A is a scale coefficient. Within this general "Cobb-Douglas" function, the labor input was, for the purpose of analysis, broken down into its white and non-white components. Various relationships (elasticities of substitution) between white and non-white labor were assumed to represent different labor market situations.

If the South African labor market were free from racial restriction, production could be explained through the use of a function of the form:

$$(1) \quad Y = A (L_w + \gamma L_{nw})^{\alpha} K^{(1-\alpha)} e^{\lambda t}$$

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where L_w = white labor employment,
 L_{nw} = non-white labor employment and
 γ is a weighting factor to combine
labor of different productivities
into a component labor pool.

We employ this function to estimate South Africa's growth possibilities in a free labor market situation. On the basis of the available data on education and relative productivity, non-white labor is assumed to be about one-third as efficient as white labor -- that is, the labor weighting factor is assumed to be equal to 0.3. Labor's share, capital's share, and the rate of technological progress are set on the basis of estimates empirically derived, and thus are affected by the restrictive system.* This same function also is used to estimate South Africa's growth possibilities in a situation in which influx control measures are enforced. In this case, non-white employment is set equal to the present number of non-whites currently employed plus the number that might be employed in border areas and the number of available Asiatics and coloreds.** Implicit in the free labor market function is the assumption that the partial elasticity of substitution among types of labor is infinite -- that is, that white and non-white labor can be substituted for one another without affecting their average productivities.

* By setting the rate of technological progress at the level estimated for the present restrictive system, there is some danger that the growth possibilities in a free labor market situation and consequently the cost of maintaining the present restrictive system may be overestimated. The residual estimate for the restrictive system not only may embody a measure of the rate of technological progress but also may include some measure of the increased efficiency arising from changes in the racial composition of the labor force -- a factor that is measured directly in the free market function.

** It is recognized that equation (1) does not accurately reflect the influx control situation, but it is a closer approximation than the other equations, given that non-white labor is the slowest growing labor category when influx control is enforced and that whites can substitute for non-whites in production.

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If the restrictive system were enforced strictly, no substitution of labor of one race for another would be possible; white and non-white labor would enter production in a fixed ratio (the partial elasticity of substitution would be zero). Production under an enforced restrictive system could be explained through the use of a function of the form:

$$(2) Y = A (\min L)^{\alpha} K^{(1-\alpha)} e^{\lambda t}$$

where $(\min L)$ is a measure of the slowest growing labor category

In practice, the restrictive system has not been enforced strictly, as is evident from the slowly rising non-white/white ratio. Function (2), therefore, has been reformulated in terms of percentage rates of growth over time. This new formulation is based on the assumption that at any particular time the use of white and non-white labor reflects the accepted institutionally determined white/non-white labor ratio appropriate for that time, and that over time this ratio is changing.* The respecified function assumes the form:

$$(2') y = A' + \alpha (\min l) + (1 - \alpha) k$$

where y , l , and k are annual percentage rates of growth for the corresponding outputs and inputs, and A' measures the residual contribution, as does λ of equation (2).**

* The assumption is embodied in the function in the property that, in any time period t_i , the white/non-white ratio is assumed to be in equilibrium, and changes only in the slowest growing labor category are used to predict output in $t_i + 1$. In $t_i + 1$, when predicting output in $t_i + 2$, the $t_i + 1$ white/non-white ratio is then assumed to be an equilibrium ratio. Although this condition is obviously artificial, it is a reasonable approximation to the basic assumption.

** Although $(\min l)$ is a measure of the slowest growing labor category either white or non-white, in practice in most years the white category is the slower growing.

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The free labor market production function of equation (1) and the restricted labor market production function of equation (2) represent two extreme assumptions about the substitutability between labor types. Both functions, as well as all intermediate cases, including the case in which the partial elasticity of substitution among types of labor (as well as the elasticity of substitution between labor and capital) is equal to one,* are forms of a more general function. This more general and elaborate function permits the partial elasticity of substitution between labor types to be determined from the data. The production function is of the form:

$$(3) Y = A [(1 - \gamma') Lw^{-p} + \gamma' Lnw^{-p}]^{\alpha/p_K(1-\alpha)} e^{\lambda t}$$

where γ' is a productivity parameter equivalent to the γ of the free labor market production function of equation (1) and p is related to the partial elasticity of substitution between labor types by the relation:

$$\text{elasticity of substitution} = \frac{1}{p+1}$$

The distribution of income between labor and capital and within the labor category can be derived directly from most production functions. If both the labor and capital markets were competitive, α would correspond to labor's share of production and $(1 - \alpha)$ to capital's share. If the South African labor market were free from racial restriction, non-whites as a group within the labor category would receive that proportion of labor's share determined by the relation:

$$\frac{\gamma Lnw}{(Lw + \gamma Lnw)}$$

If the South African restrictive system had been strictly enforced, it would be impossible to

* See equation (4), below.

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separate the contribution of the two types of labor. The distribution of income between labor types would, therefore, be a non-economic question.

Description of the Data and Results

Adequate data were available only for manufacturing and trade. In manufacturing, a time series of annual observations of white employment, non-white employment, and capital stock in place for the period 1933-63 was used. In trade, where adequate data were available only on a cross-section rather than a time series basis, a series of observations of white employment, non-white employment, and fixed capital in each of 77 branches in 1960 was used. To project output in trade, it was assumed that efficiency (the e^t term in the production function) increased 2½% a year.

The values obtained for the parameters and test statistics for each of three of the principal functions tested in manufacturing are presented in Table A1. The \bar{R}^2 , a measure of the explanatory ability of the function, is the proportion of the variation in output explained by the linear influence of labor, capital, and time. The Durbin-Watson d statistic is a measure of the degree of first-order auto-correlation of the residuals. A d statistic near 2 indicates that one of the crucial assumptions of the underlying statistical model, the assumption that residuals are statistically independent of the previous residual value, is valid. The numbers in parentheses immediately below the estimates for the parameter value are the individual confidence limits for each parameter. The probability that the true value of the parameter will be within the confidence interval is approximately 95%.

In manufacturing, the restricted labor market function of equation (2'), with its assumption of zero elasticity of substitution between labor types, seems to provide the best estimate of the South African production relationship. If we use the free market equation, although the \bar{R}^2 is high, the calculated contribution of non-white labor is practically nil -- an unreasonable result if the labor market were free. This result is compatible,

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however, with the assumptions of equation (2'), as an increase in the non-white labor input would contribute little to production in a restricted labor market situation where, as in South Africa, white labor is generally the slowest growing labor input. The confidence intervals for the parameters in the restricted labor market function are much smaller (the parameters are more significant), although the actual parameter estimates themselves are quite similar. The estimate of labor's share (and of capital's share) is reasonable in both cases, labor's share being independently estimated at about 79% of output.

An attempt to estimate the elasticity of substitution between white and non-white labor by means of equation (3) was unsuccessful. The estimating procedure terminated when p became very large. A large p corresponds, however, to a small elasticity of substitution -- another indication of the suitability of the restricted labor market function of equation (2').

In trade, both the free labor market function of equation (1) and the general function of equation (3) appear to provide fairly good estimates of the production relationship. Although of the two the free market production function has the higher \bar{R}^2 , the estimate of labor's share seems to be unreasonably low in that function, and the parameter estimates are less significant. The results for the function of equation (3) indicate that the elasticity of substitution between labor types is equal to about one. If this result is valid, the number of parameters to be estimated may be reduced and the function substantially simplified by transforming the function into the form:

$$(4) Y = A Lw^{\alpha'} Lnw^{B'} K [1 - (\alpha' + B')]$$

where α' and B' equal the elasticity of output with respect to white and non-white labor, respectively, and $\alpha' + B'$ can be taken to be equal to labor's share.

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The results for the function of equation (4) are substantially better than the results either for function (3) or the free labor market function. The function has the highest R^2 , while the estimate of labor's combined share (and of capital's share) and of the proportion of labor's combined share going to white labor (and to non-white labor) are reasonable, these shares having been independently estimated at about 61% and 80%, respectively. Overall, it seems reasonable to conclude that production in trade in South Africa can be described adequately by the function of equation (4).

Analysis of the Import Requirements

To determine the level of domestic product and investment compatible with foreign exchange availability, a multiple regression on imports was used. Imports of goods and services, excluding factor payments, were used as a measure of imports. Gross domestic capital formation by private enterprise was used as a measure of investment, and gross domestic product less investment was used as a measure of other domestic expenditure. Time, measured in number of years from 1946, was included as variable in the regression to measure the effect of the government's import substitution program.

The results are presented in Table A3. The parameter results indicate that the ratio of imports to increases in GDP is 0.24 and to increases in investment is 0.30. The government's import substitution program has been quite successful, however, and is reducing imports for a constant level of product and investment by more than \$21 million a year.

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Table A1
Production Functions in Manufacturing

Model	df	R ²	d Statistic	Intercept A	Residual t or A'	Pooling Factor γ	Labor Share t	Elasticity of Substitution Between Labor Types
Free labor market function								
(1) $Y = A (Lw + \gamma Lnw)^{\alpha} K^{(1-\alpha)} e^{\beta t}$	28	.98	1.02	0.98 (1.18 to 0.783)	0.019 (0.031 to 0.003)	0.00000 (0.491 to -0.491)	0.764 (1.07 to 0.455)	1/
Restricted labor market function								
(2) $y = A' + \alpha(\min L) + (1-\alpha) K$	29	.98 b/	2.05 b/	-	0.030 (0.032 to 0.008)	-	0.732 (0.929 to 0.633)	0 a/

a. Assumed in the function.

b. For transformed function -- the function was transformed (by calculating estimated output in a particular year from actual output in the previous year and the estimated percentage change in output) to make it statistically comparable to the other functions.

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Table A2
Production Function

Model	df	\bar{R}^2	d Statistic	Intercept λ
Free labor market function				
(1) $Y = A (Lw + \gamma Lnw)^{\alpha} K^{(1-\alpha)}$	74	.81	1.57	0.738 (0.812-0.669)
General function				
(3) $Y = A [(1-\gamma') Lw^{-p} + \gamma' Lnw^{-p}]^{\frac{\alpha}{p}} K^{(1-\alpha)}$	73	.74	1.88	0.900 (1.00-0.796)
Intermediate function				
(4) $Y = A Lw^{\alpha'} Lnw^{B'} K^{(1-(\alpha'+B'))}$	74	.94	1.56	0.932 (1.04-0.82)

a. Assumed in the function.

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Table A2

Production Functions in Trade

<u>Intercept A</u>	<u>Pooling Factor Y</u>	<u>Labor Share a or (a' + B')</u>	<u>Elasticity of Substi- tution Between Labor Types</u>	<u>White Labor Share</u>	<u>Non-White Labor Share</u>
0.738 (0.812-0.665)	0.375 (0.705-0.046)	0.396 (0.504-0.288)	- a/		
0.900 (1.00-0.796)	0.367 (0.659-0.075)	0.539 (0.664-0.414)	1 (-0.327)		
0.932 (1.04-0.82)		0.701	1 a/	0.591 (0.733-0.449)	0.110 (0.166-0.05)

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